FULL CONTENTS

[Claim(s)]

[Claim 1] The 1st viewing area it was displayed that the color patch of one arbitrary color and a different color patch of one arbitrary color from it were arranged by the same ratio, and was visible to the neutral colors of two colors, Compare the 2nd viewing area which displayed the monochromatic color patch, are the method of measuring the input-output behavioral characteristics of a display device, display black as one of two colors of this 1st viewing area, and white is displayed as other one color. Use as the measurement data about an input the average of each trichromatic luminance value which constitutes black, and each trichromatic luminance value which constitutes white, and each trichromatic luminance value which constitutes the monochrome of this 2nd viewing area is adjusted. It sets up so that the color of this 1st viewing area and the color of this 2nd viewing area can be most seen closely. After performing the 1st step which asks for input-output behavioral characteristics as measurement data concerning an output in each trichromatic luminance value which constitutes the monochrome of the 2nd viewing area at that time, Each trichromatic luminance value which displays black or white as one of two colors of this 1st viewing area, displays the color set up as a color of the 2nd viewing area at the previous step as other one color, and constitutes black or white, The average with the measurement data about the input of the color set up as a color of the 2nd viewing area at the step of this point is used as the measurement data about an input. Adjust each trichromatic luminance value which constitutes the monochrome of this 2nd viewing area, and it sets up so that the color of this 1st viewing area and the color of this 2nd viewing area can be most seen closely. The 2nd step which asks for input-output behavioral characteristics as measurement data concerning an output in each trichromatic luminance value which constitutes the monochrome of the 2nd viewing area at that time, As one of two colors of this 1st viewing area, the color set up as a color of this 2nd viewing area at the previous step is displayed. The measurement data about the input of the color which displayed other colors set up as a color of this 2nd viewing area at the step of other points as other one color, and was set up as a color of the 2nd viewing area at the step of this point, The average with the measurement data about the input of the color set up as a color of the 2nd viewing area at the step of these other points is used as the measurement data about an input. It sets up so that each trichromatic luminance value which constitutes the monochrome of this 2nd viewing area may be adjusted and the color of this 1st viewing area and the color of this 2nd viewing area can be most seen closely. The input-output-behavioral-characteristics measuring method of the display device which repeats the 3rd step which asks for input-output

behavioral characteristics as measurement data concerning an output in each trichromatic luminance value which constitutes the monochrome of the 2nd viewing area at that time, and asks for the input-output behavioral characteristics of a display device.

[Claim 2] The input-output-behavioral-characteristics measuring method of the display device according to claim 1 which tunes three colors finely after it adjusts by separating the component of two colors in the three primary colors, and the component of other one color, and interlocking the luminance value of these two colors and a certain amount of adjustment is under way, when adjusting each trichromatic luminance value which constitutes the monochrome of said 2nd viewing area.

[Claim 3] While increasing or decreasing the luminance value of one color in the three primary colors which constitute monochrome for two or more color patches on a two-dimensional plane in accordance with axis of one of the two in said 2nd viewing area Make it increase or decrease in accordance with the axis which intersects perpendicularly "Shave the luminance value of the two remaining colors" and which is already one of the two, and it arranges. The input-output-behavioral-characteristics measuring method of the display device according to claim 1 or 2 which uses as the measurement data about an output each trichromatic luminance value which chooses said 1st viewing area and the color patch which is visible to the nearest color among these two or more color patches, and constitutes the monochrome of the selected color patch.

[Claim 4] It is the display device with which input-output behavioral characteristics are measured by the input-output-behavioral-characteristics measuring method of a display device according to claim 1 to 3. It sets up so that said 1st viewing area and said 2nd viewing area may be displayed on the display screen, each trichromatic luminance value which constitutes the monochrome of this 2nd viewing area may be adjusted and the color of this 1st viewing area and the color of this 2nd viewing area can be most seen closely. The display device equipped with the calibration section which asks for input-output behavioral characteristics as measurement data concerning an output in each trichromatic luminance value which constitutes the monochrome of the 2nd viewing area at that time.

[Claim 5] The picture Method of amendment of a display device which computes the parameter for picture amendment based on the measurement data of input-output behavioral characteristics for which it asked with the input-output-behavioral-characteristics measuring method of the display device according to claim 1 to 3, and performs color correction of a picture using this parameter.

[Claim 6] The ICC Profile creation method of the display device which creates the data for ICC Profiles based on the measurement data of input-output behavioral characteristics for which it asked with the input-output-behavioral-characteristics measuring method of the display device according to claim 1 to 3, and creates an ICC Profile using this data.

[Claim 7] The ICC Profile creation method of the display device according to claim 6 which updates an ICC Profile based on the data for said ICC Profiles.

[Claim 8] The parameter for picture amendment is computed based on the measurement data of input-output behavioral characteristics for which it asked with the input-output-behavioral-characteristics measuring method of the display device according to claim 1 to 3. The creation method of the ICC Profile according to claim 6 or 7 which adjusts the data which constitutes an ICC Profile while displaying simultaneously on the display screen the original picture and the picture amended using this parameter and comparing two pictures.

[Claim 9] The storage which made the procedure of the input-output-behavioral-characteristics measuring method of a display device according to claim 1 to 3, or the picture Method of amendment of

a display device according to claim 5 memorize.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] A display device with possible this invention measuring input-output behavioral characteristics, without a user using measuring equipment for exclusive use, and its input-output-behavioral-characteristics measuring method, The simulation of the ability of a picture to be [how] seen based on the measured data is carried out. The picture Method of amendment of a display device which can be finely tuned so that a picture may be amended on real time, the difference between the original picture and the picture after amendment can be checked and how the picture is visible may become the optimal further, It is related with the storage which made those procedures remember it to be the ICC Profile creation method which creates an ICC Profile from the measured data.
[0002]
[Description of the Prior Art] How whose color is visible for every means of displaying differs between a liquid crystal display or display devices including CRT by the difference in contrast, a saturation limit (color gamut), a brightness property, etc. Moreover, how whose color is visible with the Lighting Sub-Division conditions in the environment where the display device was installed, and the angle when seeing a display device and distance, and the method of touch change. Furthermore, since a device property changes with secular change, even if the property at the time of shipment is the same, a property changes with how after that is used.
[0003] furthermore, when exchanging the peripheral device and data of a printer, a scanner, etc. how whose picture is visible even if it naturally comes out that input-output behavioral characteristics differ from a color gamut, there is and devices differ is the same -- making -- it is necessary to carry out the calibration of the property to a sake, and to create to it the profile which described the property for every device
[0004] In order for a color management system (CMS) to appear between such devices and to lessen the difference of a direction, suitable color conversion is performed based on the profile for every device. However, if it is a display device, for example in order to create a profile suitable for each device, measuring equipment, such as a spectral colorimetry meter, is needed. However, since high-precision measuring equipment is a large sum, it is difficult to measure uniquely by the user side.
[0005] Moreover, although preparing a profile by the maker side at the time of shipment is also considered, when change of the Lighting Sub-Division conditions by the side of a user or the display properties by secular change is large, even if it prepares a profile by the maker side at the time of shipment, there is a problem that how whose color is visible shifts.
[0006] So, the method of measuring a property only by software, without using measuring equipment is indicated by JP,H7-285241,A and JP,H11-338443,A about the display device.
[0007]
[Problem to be solved by the invention] However, the technology currently indicated by JP,H7-285241, A displays a patch of grayscale based on the gamma curve corresponding to the gamma value of n pieces about brightness, and chooses which gamma value is the linear. For this reason, input-output behavioral characteristics are inapplicable to the display device using the liquid crystal which cannot be expressed with a single gamma value in many cases.

[0008] Moreover, the technology currently indicated by JP,H11-338443,A is also premised on having a gamma property. For example, in the case of 24-bit color display, the value to which the middle gray of white and black was changed with RGB= (0, 0, 0), (1, 1, 1), (2, 2, 2), ..., (255,255,255) is used. Here, it expresses that are each luminance value of R (red), G (green), and B (blue), and set maximum to 255, it sets the minimum to 0, and it is the brightest in the inside of () in the greatest case, and the darkest in the minimum case.

[0009] However, since a blue chisel appears strongly, for example in the case of a liquid crystal display, color doubling is not necessarily made by this method. Furthermore, if the strength of R, G, and B differs similarly about the halftone of monochrome (red, blue, green) and black, in order that tone may change, there is a problem that it is difficult to perform color doubling correctly. In the case of a liquid crystal display, especially CRT shows a different property in respect of gradation dependence of the maximum saturation, a brightness property, the angle-of-visibility dependability of a chromaticity, and a chromaticity property etc. in many cases.

[0010] That is, in the display device using the usual liquid crystal, in order that a property might change for each RGB color in halftone, a brightness property could not be approximated by a gamma curve, but accuracy was lacked with the point of uniting a color by the conventional method.

[0011] Also in the display device which is made in order that this invention may solve the technical problem of such conventional technology, and cannot express input-output behavioral characteristics only with a gamma value or a gamma property like a liquid crystal display The input-output-behavioral-characteristics measuring method of the display device which can perform a suitable calibration, without using expensive measuring equipment, and can create an ICC Profile based on measurement data, It aims at offering the storage and display device which memorized the procedure of the picture Method of amendment of a display device, the ICC Profile creation methods of a display device, and those methods.

[0012]

[Means for solving problem] The 1st viewing area which the input-output-behavioral-characteristics measuring method of the display device of this invention arranges the color patch of one arbitrary color, and a different color patch of one arbitrary color from it by the same ratio, and was displayed that it is visible to the neutral colors of two colors, Compare the 2nd viewing area which displayed the monochromatic color patch, are the method of measuring the input-output behavioral characteristics of a display device, display black as one of two colors of this 1st viewing area, and white is displayed as other one color. Use as the measurement data about an input the average of each trichromatic luminance value which constitutes black, and each trichromatic luminance value which constitutes white, and each trichromatic luminance value which constitutes the monochrome of this 2nd viewing area is adjusted. It sets up so that the color of this 1st viewing area and the color of this 2nd viewing area can be most seen closely. After performing the 1st step which asks for input-output behavioral characteristics as measurement data concerning an output in each trichromatic luminance value which constitutes the monochrome of the 2nd viewing area at that time, Each trichromatic luminance value which displays black or white as one of two colors of this 1st viewing area, displays the color set up as a color of the 2nd viewing area at the previous step as other one color, and constitutes black or white, The average with the measurement data about the input of the color set up as a color of the 2nd viewing area at the step of this point is used as the measurement data about an input. Adjust each trichromatic luminance value which constitutes the monochrome of this 2nd viewing area, and it sets up so that the color of this

1st viewing area and the color of this 2nd viewing area can be most seen closely. The 2nd step which asks for input-output behavioral characteristics as measurement data concerning an output in each trichromatic luminance value which constitutes the monochrome of the 2nd viewing area at that time, As one of two colors of this 1st viewing area, the color set up as a color of this 2nd viewing area at the previous step is displayed. The measurement data about the input of the color which displayed other colors set up as a color of this 2nd viewing area at the step of other points as other one color, and was set up as a color of the 2nd viewing area at the step of this point, The average with the measurement data about the input of the color set up as a color of the 2nd viewing area at the step of these other points is used as the measurement data about an input. It sets up so that each trichromatic luminance value which constitutes the monochrome of this 2nd viewing area may be adjusted and the color of this 1st viewing area and the color of this 2nd viewing area can be most seen closely. The 3rd step which asks for input-output behavioral characteristics as measurement data concerning an output in each trichromatic luminance value which constitutes the monochrome of the 2nd viewing area at that time is repeated, it is asking for the input-output behavioral characteristics of the display device, and the above-mentioned purpose is attained by that.

[0013] When adjusting each trichromatic luminance value which constitutes the monochrome of said 2nd viewing area, after it adjusts by separating the component of two colors in the three primary colors, and the component of other one color, and interlocking the luminance value of these two colors and a certain amount of adjustment is under way, it is desirable to tune three colors finely.

[0014] While increasing or decreasing the luminance value of one color in the three primary colors which constitute monochrome for two or more color patches on a two-dimensional plane in accordance with axis of one of the two in said 2nd viewing area Make it increase or decrease in accordance with the axis which intersects perpendicularly "Shave the luminance value of the two remaining colors" and which is already one of the two, and it arranges. It is desirable to use as the measurement data about an output each trichromatic luminance value which chooses the color patch which is visible to said 1st viewing area and the nearest color among these two or more color patches, and constitutes the monochrome of the selected color patch.

[0015] The display device of this invention is a display device with which input-output behavioral characteristics are measured by the input-output-behavioral-characteristics measuring method of the display device of this invention. It sets up so that said 1st viewing area and said 2nd viewing area may be displayed on the display screen, each trichromatic luminance value which constitutes the monochrome of this 2nd viewing area may be adjusted and the color of this 1st viewing area and the color of this 2nd viewing area can be most seen closely. It has the calibration section which asks for input-output behavioral characteristics as measurement data concerning an output in each trichromatic luminance value which constitutes the monochrome of the 2nd viewing area at that time, and the above-mentioned purpose is attained by that.

[0016] The picture Method of amendment of the display device of this invention computes the parameter for picture amendment based on the measurement data of input-output behavioral characteristics for which it asked with the input-output-behavioral-characteristics measuring method of the display device of this invention, color correction of the picture is performed using this parameter, and the above-mentioned purpose is attained by that.

[0017] [the ICC Profile creation method of the display device of this invention] The data for ICC Profiles is created based on the measurement data of input-output behavioral characteristics for which it

asked with the input-output-behavioral-characteristics measuring method of the display device of this invention, the ICC Profile is created using this data, and the above-mentioned purpose is attained by that.

[0018] It is desirable to update an ICC Profile based on the data for said ICC Profiles.

[0019] The parameter for picture amendment is computed based on the measurement data of input-output behavioral characteristics for which it asked with the input-output-behavioral-characteristics measuring method of the display device of this invention. It is desirable to adjust the data which constitutes an ICC Profile, displaying simultaneously on the display screen the original picture and the picture amended using this parameter, and comparing two pictures.

[0020] The storage of this invention makes the procedure of the input-output-behavioral-characteristics measuring method of the display device of this invention, or the picture Method of amendment of the display device of this invention have memorized, and the above-mentioned purpose is attained by that.

[0021] An operation of this invention is explained hereafter.

[0022] The 1st viewing area which has arranged the color patch of white and black by the same ratio if it was in this invention, It is possible to measure the RGB value of the gray which is the middle of white and black by comparing the 2nd viewing area which displayed the color patch of the monochrome which consists of the three primary colors, and adjusting and setting up each luminance value of R of the 2nd viewing area, G, and B so that both sides may be in agreement and may appear. If each luminance value of R, G, and B cannot be balanced at this time, the color gap to which it seems that the color has arrived at the gray which must be a monotone will take place, and white balance will collapse. Even in such a case, since not the luminance value of a hardware level but the value which saw by man's eyes and was able to balance RGB can be used by adjusting each luminance value of R, G, and B, while performing exact color doubling, it becomes possible to measure a brightness characteristic curve. Thus, by repeating a calibration, it is possible to obtain the measurement data showing the input-output behavioral characteristics of a display device.

[0023] First, by the same ratio, it arranges and displays that the color which uses the luminance value of 0 (black) and 255 (white) first, and is equivalent to the middle input value 128 (gray) at the 1st viewing area can be seen, the luminance value of the 2nd viewing area is adjusted and an output value is measured so that it and how to be visible may be in agreement, and it asks for input-output behavioral characteristics. Furthermore, create the color which is equivalent to the middle 64 using the luminance value of 0 and measured 128, and it asks for input-output behavioral characteristics. A maximum of 256 steps of input-output behavioral characteristics can be obtained by creating the color which similarly is equivalent to the middle 192 from the luminance value of 255 and measured 128, asking for input-output behavioral characteristics, and measuring repeatedly with ... This enables it to perform exact measurement, when measuring the input-output behavioral characteristics of display devices, such as CRT and a liquid crystal display, only by software.

[0024] If each luminance value of R, G, and B is freely changed at this time, flexibility will be too high and measurement will take time. Therefore, when the component (for example, R and G) of two colors in the three primary colors and the component (for example, B) of other one color were separated, the luminance value (for example, R, G) of two colors is interlocked, a luminance value is adjusted and a certain amount of adjustment is under way, it is desirable to tune all the components of three colors (R, G, B) finely.

[0025] Furthermore, arrange two or more color patches on a two-dimensional plane, and the luminance

value of one color (for example, B) is increased or decreased in accordance with axis (for example, X-axis) of one of the two. a comparison object increases and it becomes easy to adjust each luminance value by also obtaining two colors (for example, R and G), and making it increase or decrease in accordance with axis (for example, Y-axis) of one of the two.

[0026] Thus, it becomes possible to tune measurement data finely, simulating how the picture for evaluation is amended based on the measured data, and comparing the picture after amendment with the original picture. Furthermore, all the data (for example, the contents of the tags, such as a maker and a comment) which constitutes not only the measured data but an ICC Profile can be adjusted at this time.

[0027] Furthermore, inverse transformation of an input and an output is performed from the data of the input-output behavioral characteristics which carried out in this way and were measured, and it becomes possible to create the data for ICC Profiles. Since the gamma data of an ICC Profile can store not only a gamma value but a gamma property as a table for a maximum of 32 bits, it is enough to store the gamma table used as a maximum of 256 steps measured as mentioned above, for example. Therefore, high-precision picture amendment is performed or it becomes possible to create an ICC Profile. Furthermore, he is able to graph-ize, and for a user to be able to check immediate data or to enable it to correct data in that case.

[0028] [since the data of the measured input-output behavioral characteristics is aligned with data when the change in white from black is linear as mentioned above, it is necessary to change data in fact based on this but, and] It is also possible to create the data for ICC Profiles based on the measured data, to create an ICC Profile newly, and to save or to save in the formats (PNG, TIFF, etc.) which can build in an ICC Profile. Thus, when an ICC Profile is made to build in, it becomes being the same as that of the tone seen in the environment which created the original picture by using the application which performs color conversion using the profile and the profile for other output devices which were built in. Therefore, the validity in the environment using other machines and different ICC Profiles can be checked.

[0029] In addition, even if it uses this invention, no data may be immeasurable by the user side. Moreover, since R, G, B, and the chromaticities range of the white point serve as an important element when how whose color is visible is specified, preparing beforehand is desirable [if it is only required information absolutely even if there is no updating means, it is possible to create an ICC Profile, but]. Therefore, it is desirable to enable it to update an ICC Profile based on the measured I / O data.

[0030]

[Mode for carrying out the invention] The form of this operation is explained hereafter, referring to Drawings.

[0031] First, the input-output-behavioral-characteristics measuring method (the method of a calibration) of the display device which is one embodiment of this invention is explained. Drawing 1 (a) shows the case where only one monochromatic color patch (the 2nd viewing area) is displayed. Here, the color patch of two colors with which Pat(color patch) A and PatB constitute a background pattern (the 1st viewing area) is shown, and PatC shows a monochromatic color patch (the 2nd viewing area).

[0032] for example, to measure the gray which is the middle of white and black noting that the screen mode of a display device is a 24-bit mode and each of R, G, and B consists of 256 gradation PatA is made black [= (R, G B) (0, 0, 0)], and PatB is made white [= (R, G, B) (255,255,255)]. And by arranging white and black by the same ratio, PatA and PatB are arranged so that it may average as shown in drawing 1 (a), and it may be visible to gray. [about arrangement of PatA and PatB, as shown

in drawing 1 (b), the pattern which repeats PatA and PatB by turns by a pixel unit is the most desirable, but] You may be the pattern which repeats PatA and PatB for every pixel to a screen lengthwise direction, or repeats PatA and PatB for every dot in a screen longitudinal direction.

[0033] PatA, the background pattern which consists of PatB(s), and color patch PatC can make both comparison easy by arranging in piles or arranging adjacently. And if each value of R of PatC, G, and B is adjusted, it sets up appropriately and PatA, the color (color which is visible on the average) made from PatB, and the color of PatC suit R and G which constitute the gray component which are the black at the time of assuming that the luminance change from black to white is linear and white neutral colors, and B value can be acquired.

[0034] Here, although the initial value of PatC is simple to be referred to as (128, 128, 128), it may use the value drawn from the data of an original ICC Profile, or it may lead on the assumption that a gamma property.

[0035] Furthermore, the luminance value of R, G, and B is made to fluctuate respectively, and if all the values of R, G, and B are freely changed when PatA, the color made from PatB, and the color of PatC are coincided, before reaching the color whose flexibility is too high and which is in agreement, it will take time. For this reason, when it dissociates like the component which R and G are interlocked with [make / (R G)] first, and the component of (B), each value is adjusted and a certain amount of adjustment is under way, it is desirable to tune all the components of R, and G and B finely.

[0036] Since a comparison object will decrease and adjustment of a color will become difficult about the data of a color patch if too small, as shown in drawing 2 , you may form two or more monochromatic color patches P0-P8. In this case (R, G), Y axial direction (screen lengthwise direction) and (B) can be taken to X axial direction (screen longitudinal direction), and two or more color patches can be arranged on those system of coordinates.

[0037] For example, as shown in drawing 2 , the color patch PatC which is observing Pat4 of middle of the screen now is arranged, the color patch which reduced only B component from Pat4 is arranged to Pat1, and the color patch which increased only B component from Pat4 is arranged to Pat7. Moreover, to Pat3, the color patch which increased both R component and G component from Pat4 is arranged, and the color patch which reduced both R component and G component from Pat4 is arranged to Pat5.

[0038] [here / consider it as Pat4=PatC= (128,128,128), and / the amount of change of R] if the amount of change of D [g] and B is set to D [b] for the amount of change of D [r] and G Pat0= (128+D [r], 128 +D [g], 128-D [b]), Pat1= (128,128,128-D [b]), Pat2= (128-D [r], 128-D [g], 128-D [b]), Pat3= (128+D [r], 128+D [g], 128), Pat4= (128,128,128), Pat5= (128-D [r], 128-D [g], 128), Pat6= (128+D [r], 128+D [g], 128+D [b]), Pat7= (128,128,128+D [b]), Pat8= (128-D [r], 128-D [g], 128+D [b])

It becomes. However, it is considered as the value which pulled the value from 256 when one calculated value of R, G, and B became less than zero, and in becoming 256 or more, it considers it as the value which subtracted 256. In addition, even if D [r], D [g], and D [b] are respectively the same, they may differ from each other, and you may change them with the value of Pat4.

[0039] In adjusting each luminance value, all the (B) components currently displayed if a scroll button is pushed and the right is scrolled for example, increase. If the left is scrolled, the (B) component will decrease, if it is made to scroll upwards, the component of R and G will increase, and if it sets up as the component of R and G will decrease, if it is made to scroll downward, it will become easy to treat a user (user) intuitively.

[0040] Or as shown in drawing 3 , you may set up as P4 [new] by clicking either of P0 to P8 using

pointing devices, such as a mouse and a pen, without making it scroll. In this case, the color of the selected color patch is set to P4 [new], it can arrange to middle of the screen, and the relation with the color patch of the circumference of it can be made to be the same as that of change before.
[0041] Furthermore, after it interlocks two colors and a certain amount of adjustment is under way, fine tuning of R, G, and B can be performed. For example, in the above-mentioned example which adjusted what interlocked R and G, and B, when adjustment is under way to some extent, B is left as it is, R is taken to Y axial direction, B is taken to X axial direction, on the system of coordinates, two or more color patches are arranged and same adjustment is performed. As long as there is necessity, you may amend until conviction goes changing how taking such an axis with R, B, R, G and G, R, etc.
[0042] Thus, an output value (R128, G128, B128) is acquired from the color patch of the monochrome the gray (input value (128,128,128)) which arranges and made white and black from the same ratio, and whose how to be visible correspond.
[0043] Next, the gray of 1/4 near the black side is measured between black and white. The background pattern which has arranged the black (0, 0, 0) color patch and the color patch of the measured gray (R128, G128, B128) like the above so that a ratio may become the same, By comparing and choosing a monochromatic color patch, the output value (R64, G64, B64) of 1/4 gray (input value (64, 64, 64)) is measured.
[0044] Thus, by comparing and choosing the background pattern which has arranged the black (0, 0, 0) color patch and the color patch of the measured gray so that a ratio may become the same, and a monochromatic color patch The background pattern which could measure the input-output behavioral characteristics of the middle color of black and gray, and has arranged the white (255,255,255) color patch and the color patch of the measured gray so that a ratio may become the same, By comparing and choosing a monochromatic color patch, the input-output behavioral characteristics of the middle color of white and gray can be measured.
[0045] As mentioned above, a high-precision linear gray-scale pattern can be obtained by repeating selection of the color patch a background pattern and whose how to be visible correspond, and performing it. therefore, R of a display device which has the display properties which cannot be determined only with a gamma value, G, and B -- each brightness property can be acquired.
[0046] In addition, since the brightness property acquired here is premised on a linear property which was mentioned above, when performing picture amendment or creating an ICC Profile using this, it needs to change data.
[0047] [an ICC Profile] although an ICC Profile is usually treated as a file It is possible also for embedding to actual image data, and For example, PICT (Quick Draw Picture), It can embed at graphics formats, such as EPS (Encapsulated Post Script), TIFF (Tag Image File Format), and PNG (Portable Network Graphics). The ICC Profile has a tag as usually shown in header information as shown in the following table 1, and the following table 2.
[0048]
[Table 1]

◎ヘッダ情報

byte(s)		
0-3	・Profile size	ファイルサイズ
4-7	・cmmID	他のプロファイルとの衝突を避けるためのID
8-11	・Profile version	プロファイルのバージョン
12-15	・Profile/Device class	デバイスの種類
16-19	・Color space	入力データの色空間
20-23	・Profile connection space	出力データの色空間
24-35	・Data and Time	作成時刻
36-39	・Profile file signature	プロファイルのシグネーチャ
40-43	・Primary platform	プロファイルが適用されるプラットフォーム
44-47	・Profile flags	プロファイルの種類を示す
48-51	・Device manufacturer	このプロファイルを使うデバイスの製造元
52-55	・Device model	このプロファイルを使うデバイスのモデル
56-63	・Device attributes	デバイスの属性
64-67	・Rendering intent	レンダリング方式
68-79	・Profile illuminant	照明の XYZ 値 (D50)
80-127	・拡張用（通常は 80-84 にプロファイル作成者を格納）	

[0049]

[Table 2]

◎タグ

・mediaWhitePointTag	白色点の XYZ 値
・blueColorantTag	青の相対 XYZ 値
・greenColorantTag	緑の相対 XYZ 値
・redColorantTag	赤の相対 XYZ 値
・blueTRCTag	青色のトーンカーブ
・grayTRCTag	灰色のトーンカーブ
・greenTRCTag	緑色のトーンカーブ
・redTRCTag	赤色のトーンカーブ

カウント =0: 傾きが 1 の直線
=1: データはガンマ値を示す
=2: データは直線の始点と終点を示す
>2: データはカウント個の組でトーンカーブを示す

[0050] Among these, it is header information, and indispensable one is proper as an ICC Profile, even if there is no tag. A tag consists of a kind of a count (the number of data), and data, and actual data, and

since no less than 40 kinds of tags are prepared, it shows only the part in Table 2. Usually, eight tag +copyright tag + text information tags shown in the above-mentioned table 2 are prepared in many cases. However, grayTRCTag is seldom used.

[0051] To the data measured as mentioned above, such data for the brightness characteristic curves (rTRC, gTRC, bTRC) of an ICC Profile performs inverse transformation which replaces an input and an output, and is led.

[0052] Thus, a criteria component assumes that input-output behavioral characteristics are 1:1 among the data computed by performing measurement by viewing on the basis of one color component (for example, G component). This is because criteria are needed when performing color correction of a picture. And an input and an output are made into an output value about G component, about other two color components (R component and B component), an output characteristic remains as it is, and only input characteristics use the output value of G component as a new input component. performing linear interpolation and spline interpolation about the value which carries out based on this and has not been measured -- R, G, and B -- since 255 steps of each tables can be created, the table can amend image data appropriately.

[0053] For example, [PatA and PatB] when the input-output behavioral characteristics of the middle gray (128, 128, 128) are measured as white and black, supposing the luminance value of PatC is (R128, G128, B128) In the relation of I/O, about G component, the relation to = (an input value, output value) (128, B128) of I/O becomes [the relation of I/O] about = (an input value, output value) (128, R128) and B component about = (an input value, output value) (128, G128) and R component. As shown in (G128, B128), when it changes by assuming that G component is linear at this time, as for G component, (128,128) and R component are expressed in (G128, R128), and B component. The calculation result which performed such conversion to all the measure points can be used as a parameter for picture amendment.

[0054] For example, if it changes by this method when the measurement data of input-output behavioral characteristics as shown in drawing 4 is obtained, the translation table for amendment as shown in drawing 5 will be obtained. In addition, in these figures, a horizontal axis shows an input and the vertical axis shows the output. Moreover, in drawing 4 and drawing 5 , the upper curve shows the input-output-conversion table of R and G, and the lower curve shows the input-output-conversion table of B.

[0055] (Embodiment 1) Drawing 6 is a block diagram for explaining the ICC Profile creation method which is one embodiment of this invention. First, the measurement data 101 which was mentioned above by the calibration section 100 is obtained. The calibration section 100 is a portion which displays a screen as shown in drawing 3 on a user, and displays the monochrome color patch which seems to change a background pattern one after another and to suit it.

[0056] Next, the measurement data 101 is sent to the ICC Profile generation means 102. According to a format, by considering required information as a file, the ICC Profile generation means 102 is an output thing, performs inverse transformation of I/O which was mentioned above, and changes the measurement data 101. For example, by replacing a property entry of data and an output as shown in drawing 4 , the translation table for ICC Profiles (in a horizontal axis, an input and a vertical axis output) as shown in drawing 7 is created. It carries out based on ICC Profile 103 which it was created before or the maker prepared using this table, and new ICC Profile 104 is created. In this case, creating newly is also possible although it means updating an ICC Profile.

[0057] (Embodiment 2) Drawing 8 is a block diagram for explaining the ICC Profile creation method and picture Method of amendment which are other embodiments of this invention. First, the measurement data 101 which was mentioned above by the calibration section 100 is obtained.
[0058] Next, the measurement data 101 is sent to both the ICC Profile generation means 102 and the datcoord means 105.
[0059] With the ICC Profile generation means 102, inverse transformation of I/O is performed like the embodiment 1, the measurement data 101 is changed, it carries out based on ICC Profile 103 which it was created before or the maker prepared, and new ICC Profile 104 is created.
[0060] On the other hand, the measurement data 101 sent to the datcoord means 105 is used, when changing the picture 108 for evaluation. With the image amendment means (picture amendment means) 106, it amends by carrying out the data of a picture based on the input-output-conversion table for picture amendment, and changing it by a pixel unit. The datcoord means 105 is a means to amend the curve itself, when the control point is established in the curve of input-output behavioral characteristics and a user moves the point using a pointing device.
[0061] The amended picture and the original picture (picture before amendment) 108 are displayed on the display screen of the display device 107, and comparing both pictures, they change input-output behavioral characteristics so that a user may mean by the datcoord means 105. With the image amendment means 106, a display image is changed in the field which changes an original picture into the display image which reflects input-output behavioral characteristics again, and displays the amended picture using the information. It is possible to repeat amendment of the picture by such datcoord means 105 and the image amendment means 106, and to perform it.
[0062] For example, as shown in drawing 9 , an original picture is displayed on the field at the upper left of a screen, and the picture after color conversion is displayed on the field of the top right of the screen. For example, by drawing 9 , a lower curve shows B, and the upper curve shows R and G by it. Moreover, the header information of an ICC Profile and the main tag information are displayed on the field at the lower left of a screen, a change is also suitably made possible and the data (for example, table of drawing 7) which changed measurement data into ICC Profiles is displayed on the field at the lower right of a screen.
[0063] Furthermore, in order to change independently each value of R, G, and B, the button for selection of R, G, and B under a lower right viewing area is pushed, and it enables it to adjust the curve of the color component pushed in this embodiment.
[0064] Thus, it indicates how a picture is changed based on measurement data, and measurement data can be tuned finely again, looking at the display, and the parameter for ICC Profiles can be created now from the adjusted measurement data.
[0065] As mentioned above, when performing calibrations, such as CRT and a liquid crystal display, using software, an exact parameter is created, and it becomes possible to pass the ICC Profile generation means 102 and the image amendment means 106.
[0066] Furthermore, as shown in drawing 10 , it carries out based on newly created ICC Profile 104. It is also possible to create the image data (PNG, TIFF, etc.) which embedded the ICC Profile at the image data 110, and built in the ICC Profile by the image data creation means 109 which built in ICC Profile 109. This image data creation means 109 consists of readings and the write-in routines corresponding to a graphics format, and when it saves the picture which adjusted, it serves as a portion which embeds the data of an ICC Profile at an image file.

[0067] Below, the concrete procedure of the calibration common to the above-mentioned embodiment 1 and the embodiment 2 is explained using the flow chart of drawing 11 .

[0068] First, initial value is set up in Step 1. Here, two colors which constitute a background pattern (the 1st viewing area) are set to PatA and PatB, and each input value is set to PatA_n=255 and PatB_n=0. R [255], G [255], and B [255] show a luminance value in case each input signal is 255, and substitute 255, respectively. Moreover, R [0], G [0], and B [0] show a luminance value in case each input signal is 0, and substitute 0, respectively.

[0069] Next, in Step 2, a background pattern is displayed on the display screen. It arranges so that PatA and PatB may become the same ratio, and it is made visible to gray at this time on the average. In this embodiment, PatA and PatB have been arranged like drawing 1 (b).

[0070] Next, in Step 3, initial value of the monochrome color patch PatC (the 2nd viewing area) is set up. Here, PatC_n is an input luminance value to calculate and is taken as PatA_n and the average (mean value) of PatB_n. Furthermore, the color which constitutes PatC makes R [PatC_n] the average of R [PatA_n] and R [PatB_n]. Make G [PatC_n] into the average of G [PatA_n] and G [PatB_n], and let B [PatC_n] be the average of B [PatA_n] and B [PatB_n]. These values are mere initial value and it is also possible to carry out based on the original ICC Profile which the maker offers, and former measurement data, and to set up initial value.

[0071] Next, in Step 4, as PatC is made to adjoin PatA and PatB of a background pattern or it was shown in drawing 1 (a), it displays on a background pattern. Furthermore, in displaying two or more monochrome color patches, it also sets and displays the color patch of the circumference of it besides PatC. At this time, the color of a surrounding color patch can be easily drawn from the RGB value of main PatC.

[0072] for example, as shown in drawing 2 , in displaying nine monochrome color patches Pat0= (R [PatC_n]+D[r] G[PatC_n]+D[g] B[PatC_n]-D [b]), Pat1= (R[PatC_n] G[PatC_n] B[PatC_n]-D [b]), Pat2= (R[PatC_n]-D[r] G[PatC_n]-D[g] B[PatC_n]-D [b]), Pat3= (R[PatC_n]+D[r] G[PatC_n]+D [g], B [PatC_n]), Pat4= (R [PatC_n], G [PatC_n], B [PatC_n]), Pat5= (R[PatC_n]-D[r] G[PatC_n]-D [g], B [PatC_n]), Pat6= (R[PatC_n]+D[r] G[PatC_n]+D[g] B[PatC_n]+D [b]), Pat7= (R[PatC_n] G[PatC_n] B [PatC_n]+D [b]), Pat8= (R[PatC_n]-D[r] G[PatC_n]-D[g] B[PatC_n]+D [b])

** -- it becomes like. However, when one calculated value of R, G, and B becomes less than zero, it is considered as the value which pulled the value from 256, and in becoming 256 or more, it makes it become the value which subtracted 256.

[0073] Next, in Step 5, when two or more monochrome color patches are being displayed, it sees from a user and a background pattern (middle color of PatA and PatB) and the nearest color are chosen from monochrome color patches. Moreover, only in the case of one, a monochrome color patch changes a color only with a scroll button.

[0074] And in Step 6, in determining, it progresses to Step 7, and when it is judged that the color has not approached yet, it returns to Step 3.

[0075] As shown in drawing 1 (a), only in the case of one, the monochrome color patch PatC changes a luminance value, and expresses a new color to it as Step 3. Moreover, as shown in drawing 2 , when two or more monochrome color patches are used, the luminance value of each color patch is changed. In addition, when displaying a new color, and separate a component like a component (R, G) and the (B) component, two components are interlocked, it adjusts and a certain amount of adjustment is under way,

it is desirable to tune all the components of R, G, and B finely.
[0076] At Step 7, if it is an end, it will progress to Step 9 and measurement data will be written out. Here, (128, R128), (128, G128), and (128, B128) are obtained as measurement data of I/O. Measurement data is stored in memory at this time. Moreover, when it does not end at Step 7, it progresses to Step 8.
[0077] At Step 8, PatA and PatB are set up newly. Since it is 0, 255, and the input value of a color by which input-output behavioral characteristics were measured by then and the combination of an output value as an input value as a property known at this time, new PatA and new PatB are chosen from those combination, and it returns to Step 2.
[0078]
[Effect of the Invention] As explained in full detail above, even if it does not prepare expensive measuring equipment by the user side, according to this invention, a profile can be created according to the installed environment of a display device. Moreover, like a liquid crystal display, also in the display device which cannot express input-output behavioral characteristics only with a gamma value or a gamma property, input-output behavioral characteristics can be measured correctly and a profile can be created. Moreover, a profile can be easily updated to secular change of a display device. Furthermore, before applying a profile, by changing a picture beforehand and comparing conversion before and the conversion back, the property of the created profile can be predicted and it can adjust appropriately.

[Brief Description of the Drawings]
[Drawing 1] (a) is a figure for explaining color doubling in the input-output-behavioral-characteristics measuring method of the display device which is one embodiment of this invention, and (b) is the figure showing the example of arrangement of PatA and PatB.
[Drawing 2] In the input-output-behavioral-characteristics measuring method of the display device which are other embodiments of this invention, it is a figure for explaining color doubling.
[Drawing 3] In the input-output-behavioral-characteristics measuring method of the display device which are other embodiments of this invention, it is a figure for explaining selection of the color using a pointing device.
[Drawing 4] It is the graph which shows an example of the input-output behavioral characteristics of the measurement data obtained by this invention.
[Drawing 5] It is the graph which shows an example of the translation table for amendment obtained by this invention.
[Drawing 6] It is a block diagram for explaining the ICC Profile creation method of the embodiment 1.
[Drawing 7] It is the graph which shows an example of the table for ICC Profiles obtained by this invention.
[Drawing 8] It is a block diagram for explaining the ICC Profile creation method and picture Method of amendment of the embodiment 2.
[Drawing 9] In the ICC Profile creation method which is one embodiment of this invention, it is a figure for explaining adjustment of the data for ICC Profiles.
[Drawing 10] It is a figure for explaining the image data which built in the ICC Profile created by this

invention.

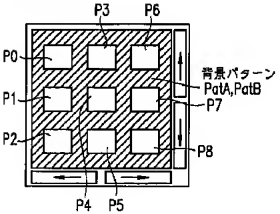
[Drawing 11] It is a flow chart for explaining the calibration using this invention.

[Explanations of letters or numerals]

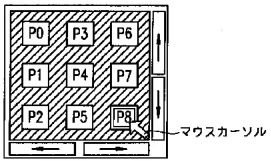
100 Calibration Section
101 Measurement Data
102 ICC Profile Generation Means
103 Former ICC Profile
104 New ICC Profile
105 Datcoord Means
106 Image Amendment Means
107 Display Device
108 Picture for Evaluation
109 Image Data Creation Means Which Built in ICC Profile
110 Image Data
111 Image Data Creation Means Which Built in ICC Profile
PatA, PatB Color patch which constitutes a background pattern
PatC, Pat0, Pat1, Pat2, Pat3, Pat4, Pat5, Pat6, Pat7, Pat8 Monochrome color patch

---

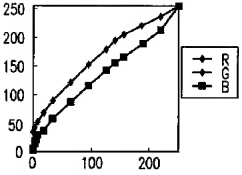
[Drawing 2]



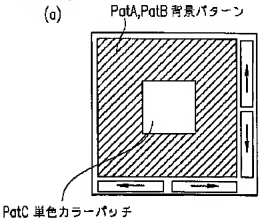
[Drawing 3]

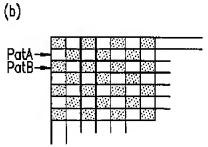


[Drawing 4]

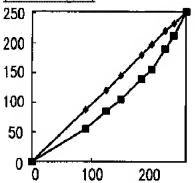


[Drawing 1]

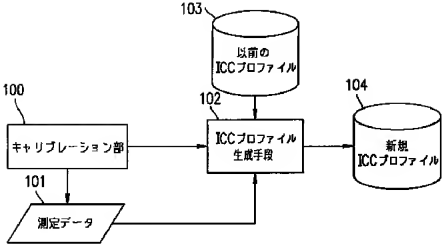




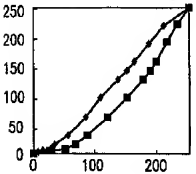
[Drawing 5]



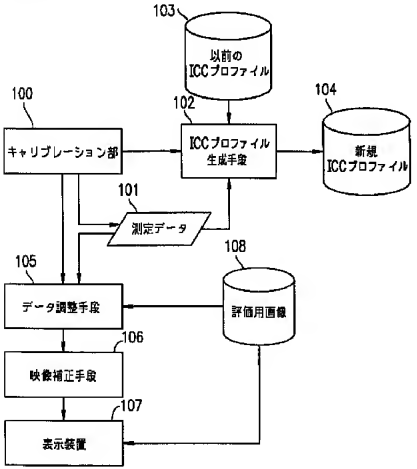
[Drawing 6]



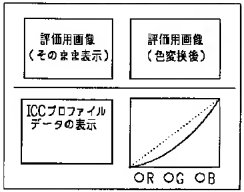
[Drawing 7]



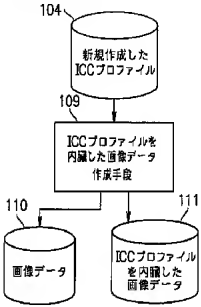
[Drawing 8]



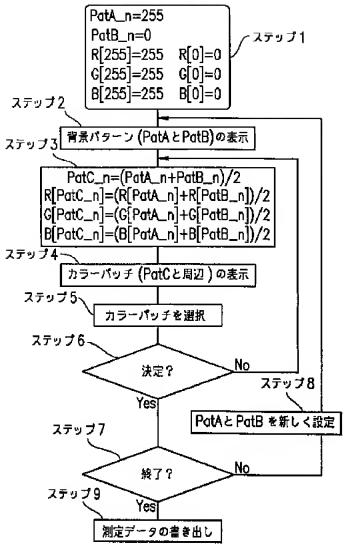
[Drawing 9]



[Drawing 10]



[Drawing 11]



[Translation done.]